WHAT IS CLAIMED IS:

1. A method for ex vivo expansion of stem cells, comprising the steps of;

(a) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:1

wherein
Xaa at position 17 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;
Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,
        Gln, Asn, Thr, Ser or Val;
Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, Asp,
        Asn, Gln, Leu, Val or Gly;
Xaa at position 23 is Ile, Val, Ala, Leu, Gly, Trp, Lys,
        Phe, Ser, or Arg;
Xaa at position 24 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;
Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
Xaa at position 26 is His, Thr, Phe, Gly, Arg, Ala, or Trp;
Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;
Xaa at position 28 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;
Xaa at position 29 is Gln, Asn, Leu, Pro, Arg, or Val;
Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
        Lys;
Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
Xaa at position 32 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro, Leu, Gln, Ala, Thr, or Glu;
Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Glu, Gln,

Thr, Arg, Ala, Phe, Ile or Met;

Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

Xaa at position 36 is Asp, Leu, or Val;

Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;

5 Xaa at position 38 is Asn, or Ala;

Xaa at position 40 is Leu, Trp, or Arg;

Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, or Pro;

Xaa at position 42 is Gly, Asp, Ser, Cys, Asn, Lys, Thr,

Leu, Val, Glu, Phe, Tyr, Ile, Met or Ala;

10 Xaa at position 43 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,

Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

Trp, Glu, Asn, Gln, Ala or Pro;

Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr,

15 Lys, Trp, Asp, Asn, Arg, Ser, Ala, Ile, Glu or His;

Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,

Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

Xaa at position 47 is Ile, Gly, Val, Ser, Arg, Pro, or His;

Xaa at position 48 is Leu, Ser, Cys, Arg, Ile, His, Phe,

20 Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 50 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

Ser, Ala, Ile, Val, His, Phe, Met or Gln;

Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;

25 Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys,

Ser, or Met;

Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln,

Asn, Lys, His, Ala or Leu;

30 Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,

His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

Xaa at position 57 is Asn or Gly;

Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

35 Xaa at position 59 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 60 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

Xaa at position 62 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 63 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 64 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;

5 Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or

       His;

Xaa at position 68 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or

10   Leu;

Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 71 is Ala, Met, Leu, Pro, Arg, Glu, Thr,

       Gln, Trp, or Asn;

Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

15 Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 74 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg,

       Ser, Gln, or Leu;

Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or

20   Asp;

Xaa at position 77 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 78 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

Xaa at position 79 is Lys, Thr, Asn, Met, Arg, Ile, Gly, or Asp;

Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

25 Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn, His,

       Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

Xaa at position 83 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;

30 Xaa at position 85 is Leu, Asn, Val, or Gln;

Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 87 is Leu, Ser, Trp, or Gly;

Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or

35   Ser;

Xaa at position 90 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, Ala,

Gly, Ile or Leu;

Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

5   Lys, His, Ala, or Pro;

Xaa at position 95 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile, or Tyr;

Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 97 is Ile, Val, Lys, Ala, or Asn;

10   Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 99 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

Gly, Ser, Phe, or His;

Xaa at position 100 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, or

15   Pro;

Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,

Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu, or Gln;

Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

Xaa at position 103 is Asp, or Ser;

20   Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

Tyr, Leu, Lys, Ile, Asp, or His;

Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

25   Xaa at position 108 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

His, Ser, Ala or Pro;

Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 110 is Lys, Ala, Asn, Thr, Leu, Arg, Gln,

His, Glu, Ser, or Trp;

30   Xaa at position 111 is Leu, Ile, Arg, Asp, or Met;

Xaa at position 112 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 113 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

Asp, Lys, Leu, Ile, Val or Asn;

Xaa at position 114 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

35   Xaa at position 115 is Leu, Asn, Val, Pro, Arg, Ala, His,

Thr, Trp, or Met;

Xaa at position 116 is Lys, Leu, Pro, Thr, Met, Asp, Val,

Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or
Ile;

Xaa at position 117 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

Xaa at position 118 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

5   Xaa at position 119 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 120 is Asn, Ala, Pro, Leu, His, Val, or Gln;

Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro,
His, Ile, Tyr, or Cys;

10   Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 1 to 14 amino acids can be deleted from
the N-terminus and/or from 1 to 15 amino acids can be
deleted from the C-terminus of said human interleukin-3

15   mutant polypeptide; and wherein from 4 to 44 of the
amino acids designated by Xaa are different from the
corresponding amino acids of native (1-133) human
interleukin-3;

20   R_2 is a hematopoietic growth factor;

L is a linker capable of Linking R_1 to R_2;
and said chimera protein can additionally be
immediately preceded by (methionine^{-1}), (alanine^{-1}), or

25   (methionine^{-2}, alanine^{-1}); and

(b) harvesting said cultured stem cells.

2.   A method for ex vivo expansion of stem

30   cells, comprising the steps of;

(a) culturing said stem cells with a selected
growth medium comprising a chimera protein having the
formula selected from the group consisting of:

35

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and
R_1-R_1

wherein R1 is a human interleukin-3 mutant
polypeptide of SEQ ID NO:4

5   wherein

Xaa at position 3 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;

Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;

Xaa at position 5 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;

Xaa at position 6 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;

10   Xaa at position 7 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,

            Gln, Asn, Thr, Ser or Val;

Xaa at position 8 is Glu, Trp, Pro, Ser, Ala, His, Asp,

            Asn, Gln, Leu, Val, or Gly;

Xaa at position 9 is Ile, Val, Ala, Gly, Trp, Lys,

15   Phe, Ser, or Arg;

Xaa at position 10 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;

Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;

Xaa at position 12 is His, Thr, Phe, Gly, Arg, Ala, or Trp;

Xaa at position 13 is Leu, Gly, Arg, Thr, Ser, or Ala;

20   Xaa at position 14 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;

Xaa at position 15 is Gln, Asn, Leu, Pro, Arg, or Val;

Xaa at position 16 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or

            Lys;

Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;

25   Xaa at position 18 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;

Xaa at position 19 is Pro, Leu, Gln, Ala, Thr, or Glu;

Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Glu, Gln,

            Thr, Arg, Ala, Phe, Ile or Met;

Xaa at position 21 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

30   Xaa at position 22 is Asp, Leu, or Val;

Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;

Xaa at position 24 is Asn, or Ala;

Xaa at position 26 is Leu, Trp, or Arg;

Xaa at position 27 is Asn, Cys, Arg, Leu, His, Met, Pro;

35   Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Lys, Asn,

            Thr, Leu, Val, Glu, Phe, Tyr, Ile or Met;

Xaa at position 29 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,

Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 30 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

Trp, Glu, Asn, Gln, Ala or Pro;

Xaa at position 31 is Gln, Pro, Phe, Val, Met, Leu, Thr,

5   Lys, Asp, Asn, Arg, Ser, Ala, Ile, Glu, His or Trp;

Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,

Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

Xaa at position 33 is Ile, Gly, Val, Ser, Arg, Pro, or His;

Xaa at position 34 is Leu, Ser, Cys, Arg, Ile, His, Phe,

10   Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 35 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 36 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

Ser, Ala, Ile, Val, His, Phe, Met or Gln;

Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;

15   Xaa at position 38 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 39 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or

Met;

Xaa at position 40 is Arg, Asp, Ile, Ser, Val, Thr, Gln,

Asn, Lys, His, Ala or Leu;

20   Xaa at position 41 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,

His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

Xaa at position 43 is Asn or Gly;

Xaa at position 44 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

25   Xaa at position 45 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 46 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 47 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

Xaa at position 48 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 49 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

30   Xaa at position 50 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 51 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 53 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or

His;

35   Xaa at position 54 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or

Leu;

Xaa at position 56 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 57 is Ala, Met, Leu, Pro, Arg, Glu, Thr,

Gln, Trp, or Asn;

Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

5   Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 60 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 61 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, Gln,

or, Leu;

Xaa at position 62 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or

10   Asp;

Xaa at position 63 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 64 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or Asp;

Xaa at position 66 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

15   Xaa at position 67 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 68 is Leu, Gln, Lys, Trp, Arg, Asp, Glu,

Asn, His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

Xaa at position 69 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 70 is Cys, Glu, Gly, Arg, Met, or Val;

20   Xaa at position 71 is Leu, Asn, Val, or Gln;

Xaa at position 72 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 73 is Leu, Ser, Trp, or Gly;

Xaa at position 74 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 75 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or

25   Ser;

Xaa at position 76 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

Xaa at position 78 is Pro, Phe, Arg, Ser, Lys, His, Ala,

Gly, Ile or Leu;

30   Xaa at position 79 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 80 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

Lys, His, Ala or Pro;

Xaa at position 81 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile or Tyr;

35   Xaa at position 82 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 83 is Ile, Val, Lys, Ala, or Asn;

Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 85 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

Gly, Ser, Phe, or His;

Xaa at position 86 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, Pro;

5 Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,

Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu or Gln;

Xaa at position 88 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

Xaa at position 89 is Asp, or Ser;

Xaa at position 90 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

10 Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

Tyr, Leu, Lys, Ile, Asp, or His;

Xaa at position 92 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

Xaa at position 94 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

15 His, Ser, Ala, or Pro;

Xaa at position 95 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 96 is Lys, Asn, Thr, Leu, Gln, Arg,

His, Glu, Ser, Ala or Trp;

Xaa at position 97 is Leu, Ile, Arg, Asp, or Met;

20 Xaa at position 98 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 99 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

Asp, Lys, Leu, Ile, Val or Asn;

Xaa at position 100 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

Xaa at position 101 is Leu, Asn, Val, Pro, Arg, Ala, His,

25 Thr, Trp, or Met;

Xaa at position 102 is Lys, Leu, Pro, Thr, Met, Asp, Val,

Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or

Ile;

Xaa at position 103 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

30 Xaa at position 104 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 105 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 106 is Asn, Ala, Pro, Leu, His, Val, or Gln;

Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro,

35 His, Ile, Tyr, or Cys;

Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding native amino acids of (1-133) human interleukin-3;

5   R_2 is a hematopoietic growth factor;

L is a linker capable of Linking R_1 to R_2; and said chimera protein can additionally be immediately preceded by (methionine^{-1}), (alanine^{-1}), or

10   (methionine^{-2}, alanine^{-1}); and

(b) harvesting said cultured stem cells.

3. A method for ex vivo expansion of stem

15   cells, comprising the steps of;

(a) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

20

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:7

25

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile; Xaa at position 19 is Met, Ala or Ile; Xaa at position 20 is Ile, Pro or Leu; Xaa at position 23 is Ile, Ala or Leu; Xaa at position 25 is Thr or His; Xaa at

30   position 29 is Gln, Arg, Val or Leu; Xaa at position 32 is Leu, Ala, Asn or Arg; Xaa at position 34 is Leu or Ser; Xaa at position 37 is Phe, Pro, or Ser; Xaa at position 38 is Asn or Ala; Xaa at position 42 is Gly, Ala, Ser, Asp or Asn; Xaa at position 45 is Gln, Val,

35   or Met; Xaa at position 46 is Asp or Ser; Xaa at position 49 is Met, Ile, Leu or Asp; Xaa at position 50 is Glu or Asp; Xaa at position 51 is Asn Arg or Ser;

Xaa at position 55 is Arg, Leu, or Thr; Xaa at position 56 is Pro or Ser; Xaa at position 59 is Glu or Leu; Xaa at position 60 is Ala or Ser; Xaa at position 62 is Asn, Val or Pro; Xaa at position 63 is Arg or His; Xaa

5 at position 65 is Val or Ser; Xaa at position 67 is Ser, Asn, His or Gly; Xaa at position 69 is Gln or Glu; Xaa at position 73 is Ala or Gly; Xaa at position 76 is Ser, Ala or Pro; Xaa at position 79 is Lys, Arg or Ser; Xaa at position 82 is Leu, Glu, Val or Trp; Xaa

10 at position 85 is Leu or Val; Xaa at position 87 is Leu, Ser, Trp; Xaa at position 88 is Ala or Trp; Xaa at position 91 is Ala or Pro; Xaa at position 93 is Pro or Ser; Xaa at position 95 is His or Thr; Xaa at position 98 is His, Ile, or Thr; Xaa at position 100 is Lys or

15 Arg; Xaa at position 101 is Asp, Ala or Met; Xaa at position 105 is Asn or Gln; Xaa at position 109 is Arg, Glu or Leu; Xaa at position 112 is Thr or Gln; Xaa at position 116 is Lys, Val, Trp or Ser; Xaa at position 117 is Thr or Ser; Xaa at position 120 is Asn, Gln, or

20 His; Xaa at position 123 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native human interleukin-3);

25   R_2 is a hematopoietic growth factor;

        L is a linker capable of Linking R_1 to R_2; and said chimera protein can additionally be immediately preceded by (methionine^{-1}), (alanine^{-1}), or

30 (methionine^{-2}, alanine^{-1}); and

        (b) harvesting said cultured stem cells.

        4. A method for ex vivo expansion of stem

35 cells, comprising the steps of;

        (a) culturing said stem cells with a selected

growth medium comprising a chimera protein having the
formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

5

wherein R_1 is a human interleukin-3 mutant
polypeptide of SEQ ID NO:8

wherein m is 0 or 1; n is 0 or 1; p is 0 or 1; Xaa at
10 position 4 is Asn or Ile; Xaa at position 5 is Met, Ala
or Ile: Xaa at position 6 is Ile, Pro or Leu; Xaa at
position 9 is Ile, Ala or Leu; Xaa at position 11 is
Thr or His; Xaa at position 15 is Gln, Arg, Val or Leu;
Xaa at position 18 is Leu, Ala, Asn or Arg; Xaa at
15 position 20 is Leu or Ser; Xaa at position 23 is Phe,
Pro, or Ser; Xaa at position 24 is Asn or Ala; Xaa at
position 28 is Gly, Ala, Ser, Asp or Asn; Xaa at
position 31 is Gln, Val, or Met; Xaa at position 32 is
Asp or Ser; Xaa at position 35 is Met, Ile, Leu or Asp;
20 Xaa at position 36 is Glu or Asp; Xaa at position 37 is
Asn, Arg or Ser; Xaa at position 41 is Arg, Leu, or
Thr; Xaa at position 42 is Pro or Ser; Xaa at position
45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa
at position 48 is Asn, Val or Pro; Xaa at position 49
25 is Arg or His; Xaa at position 51 is Val or Ser; Xaa at
position 53 is Ser, Asn, His or Gly; Xaa at position 55
is Gln or Glu; Xaa at position 59 is Ala or Gly; Xaa at
position 62 is Ser, Ala or Pro; Xaa at position 65 is
Lys, Arg or Ser; Xaa at position 67 is Leu, Glu, or
30 Val; Xaa at position 68 is Leu, Glu, Val or Trp; Xaa
at position 71 is Leu or Val; Xaa at position 73 is
Leu, Ser or Trp; Xaa at position 74 is Ala or Trp; Xaa
at position 77 is Ala or Pro; Xaa at position 79 is Pro
or Ser; Xaa at position 81 is His or Thr; Xaa at
35 position 84 is His, Ile, or Thr; Xaa at position 86 is
Lys or Arg; Xaa at position 87 is Asp, Ala or Met; Xaa
at position 91 is Asn or Glu; Xaa at position 95 is

Arg, Glu, Leu; Xaa at position 98 Thr or Gln; Xaa at position 102 is Lys, Val, Trp or Ser; Xaa at position 103 is Thr or Ser; Xaa at position 106 is Asn, Gln, or His; Xaa at position 109 is Ala or Glu; with the

5   proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native (15-125)human interleukin-3;

R$_2$ is a hematopoietic growth factor;

10

L is a linker capable of Linking R$_1$ to R$_2$; and said chimera protein can additionally be immediately preceded by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2}, alanine^{-1}); and

15

(b) harvesting said cultured stem cells.

5. The method according to claim 2 wherein R$_1$ is selected from the group consisting of:

20

```
Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
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25
```
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:9;
```
30
```
Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
```
35
```
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
```

Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:10;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:11;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:12;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:13;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn

Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:14;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:15;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:16;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:17;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys

Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
5 Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ
ID NO:18;

10 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
15 Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:19;

20 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
25 Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:20;

30 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
35 Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ

ID NO:21;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
5   Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
10 Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:22;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
15 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
20 Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:23;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
25 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
30 Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:24;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
35 Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:25;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:26;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:27;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
Gln SEQ ID NO:28;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
5   Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
Gln SEQ ID NO:29;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
10   Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
15   Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
Gln SEQ ID NO:30;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
20   Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
25   Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:31;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
30   Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
35   Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:32;

```
    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
    Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
  5 Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
    Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
    Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
    Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
 10 Gln SEQ ID NO:33;

    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
    Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
 15 Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
    Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
    Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
    Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
 20 Gln SEQ ID NO:34;

    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
    Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
 25 Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
    Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
    Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
    Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
 30 Gln SEQ ID NO:35;

    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
    Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
 35 Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
    Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
    Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
```

Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:36;

5   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
10   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:37;

15   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
20   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:38;

25   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
30   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:39;

35   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg

Leu Ser Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
5 Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:40;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ala Ile His His
Leu Lys Arg Pro Pro Ala Pro Ser Leu Asp Pro Asn Asn Leu
10 Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
15 Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:41;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
20 Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
25 Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:42;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
30 Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
35 Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:43;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Asp Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
5   Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:44;
10

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
15   Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:45;
20

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
25   Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
30   ID NO:46;

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
35   Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys

Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:47; and

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Leu Ile His His
Leu Lys Ile Pro Pro Asn Pro Ser Leu Asp Ser Ala Asn Leu
Asn Ser Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:48.

6. The method of claim 1, 2, 3, 4 or 5 wherein is R_2 is R_1 or a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser[17], c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF);

7. The method of claim 6 wherein is R_2 is selected from the group consisting of G-CSF, G-CSF Ser[17], flt3 ligand and c-mpl ligand.

8. The method of claim 2 wherein said chimera protein is selected from group consisting of: SEQ ID NO:121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 165, 166, 167 and 168.

9. The method of claim 9 wherein said chimera protein is selected from group consisting of: SEQ ID NO:124, SEQ ID NO:133, SEQ ID NO:154 and SEQ ID
5   NO:155.

10. The method of claim 1, 2, 3, 4, 5, 8 or 9 wherein said culture medium further comprises a hematopoietic growth factor selected from the group
10   consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell
15   differentiation factor, eosinophil differentiation factor and stem cell factor (SCF).

11. The method of claim 6 wherein said culture medium further comprises a hematopoietic growth
20   factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-
25   cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF).

12. The method of claim 7 wherein said
30   culture medium further comprises a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-
35   15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor

(SCF).

13. Cultured stem cells obtained by the method of claim 2.

14. Cultured stem cells obtained by the method of claim 8.

15. Cultured stem cells obtained by the method of claim 10.

16. The method of claim 1 wherein said mutant human interleukin-3 polypeptide has at least three times greater activity than native human interleukin-3, in at least one assay selected from the group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.

17. The method of claim 7 wherein said mutant human interleukin-3 polypeptide has at least three times greater activity than native human interleukin-3, in at least one assay selected from the group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.

18. The method of claim 1 further comprising the step of separating the stem cells from a mixed population of cells prior to culturing the stem cells.

19. The method of claim 18 wherein said stem cells are separated from a mixed population of cells based on the stem cells having CD34 surface antigen.

20. A method for treatment of a patient having a hematopoietic disorder, comprising the steps of;

(a) removing stem cells from said patient or a donor;

(b) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:1

wherein
Xaa at position 17 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;
Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,
        Gln, Asn, Thr, Ser or Val;
Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, Asp,
        Asn, Gln, Leu, Val or Gly;
Xaa at position 23 is Ile, Val, Ala, Leu, Gly, Trp, Lys,
        Phe, Ser, or Arg;
Xaa at position 24 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;
Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
Xaa at position 26 is His, Thr, Phe, Gly, Arg, Ala, or Trp;
Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;
Xaa at position 28 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;
Xaa at position 29 is Gln, Asn, Leu, Pro, Arg, or Val;
Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
        Lys;
Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
Xaa at position 32 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro, Leu, Gln, Ala, Thr, or Glu;
Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Glu, Gln,
        Thr, Arg, Ala, Phe, Ile or Met;
Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;
Xaa at position 36 is Asp, Leu, or Val;

Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;

Xaa at position 38 is Asn, or Ala;

Xaa at position 40 is Leu, Trp, or Arg;

Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, or Pro;

5   Xaa at position 42 is Gly, Asp, Ser, Cys, Asn, Lys, Thr,

           Leu, Val, Glu, Phe, Tyr, Ile, Met or Ala;

Xaa at position 43 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,

           Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

10   Trp, Glu, Asn, Gln, Ala or Pro;

Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr,

           Lys, Trp, Asp, Asn, Arg, Ser, Ala, Ile, Glu or His;

Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,

           Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

15   Xaa at position 47 is Ile, Gly, Val, Ser, Arg, Pro, or His;

Xaa at position 48 is Leu, Ser, Cys, Arg, Ile, His, Phe,

           Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 50 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

20   Ser, Ala, Ile, Val, His, Phe, Met or Gln;

Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys,

           Ser, or Met;

25   Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln,

           Asn, Lys, His, Ala or Leu;

Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,

           His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

30   Xaa at position 57 is Asn or Gly;

Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

Xaa at position 59 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 60 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

35   Xaa at position 62 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 63 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 64 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or

      His;

5   Xaa at position 68 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or

      Leu;

Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 71 is Ala, Met, Leu, Pro, Arg, Glu, Thr,

10   Gln, Trp, or Asn;

Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 74 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg,

15   Ser, Gln, or Leu;

Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or

      Asp;

Xaa at position 77 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 78 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

20   Xaa at position 79 is Lys, Thr, Asn, Met, Arg, Ile, Gly, or Asp;

Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn, His,

      Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

25   Xaa at position 83 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 85 is Leu, Asn, Val, or Gln;

Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 87 is Leu, Ser, Trp, or Gly;

30   Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or

      Ser;

Xaa at position 90 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

35   Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, Ala,

      Gly, Ile or Leu;

Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

Lys, His, Ala, or Pro;

Xaa at position 95 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile, or Tyr;

5   Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 97 is Ile, Val, Lys, Ala, or Asn;

Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 99 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

10   Gly, Ser, Phe, or His;

Xaa at position 100 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, or

Pro;

Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,

Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu, or Gln;

15   Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

Xaa at position 103 is Asp, or Ser;

Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

20   Tyr, Leu, Lys, Ile, Asp, or His;

Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

Xaa at position 108 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

His, Ser, Ala or Pro;

Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

25   Xaa at position 110 is Lys, Ala, Asn, Thr, Leu, Arg, Gln,

His, Glu, Ser, or Trp;

Xaa at position 111 is Leu, Ile, Arg, Asp, or Met;

Xaa at position 112 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 113 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

30   Asp, Lys, Leu, Ile, Val or Asn;

Xaa at position 114 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

Xaa at position 115 is Leu, Asn, Val, Pro, Arg, Ala, His,

Thr, Trp, or Met;

Xaa at position 116 is Lys, Leu, Pro, Thr, Met, Asp, Val,

35   Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or

Ile;

Xaa at position 117 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

Xaa at position 118 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 119 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 120 is Asn, Ala, Pro, Leu, His, Val, or Gln;

Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

5   Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro,

His, Ile, Tyr, or Cys;

Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 1 to 14 amino acids can be deleted from

10   the N-terminus and/or from 1 to 15 amino acids can be

deleted from the C-terminus of said human interleukin-3

mutant polypeptide; and wherein from 4 to 44 of the

amino acids designated by Xaa are different from the

corresponding amino acids of native (1-133) human

15   interleukin-3;

R_2 is a hematopoietic growth factor;

L is a linker capable of Linking R_1 to R_2;

20   and said chimera protein can additionally be preceded

by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2},

alanine^{-1}); and

(c) harvesting said cultured stem cells; and

25   (d) transplanting said cultured stem cells

into said patient.

21. A method for treatment of a patient

having a hematopoietic disorder, comprising the steps

30   of;

(a) removing stem cells from said patient or

a donor;

(b) culturing said stem cells with a selected

35   growth medium comprising a chimera protein having the

formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:4

5

wherein

Xaa at position 3 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;

Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;

Xaa at position 5 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;

10   Xaa at position 6 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;

Xaa at position 7 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,

        Gln, Asn, Thr, Ser or Val;

Xaa at position 8 is Glu, Trp, Pro, Ser, Ala, His, Asp,

        Asn, Gln, Leu, Val, or Gly;

15   Xaa at position 9 is Ile, Val, Ala, Leu, Gly, Trp, Lys,

        Phe, Ser, or Arg;

Xaa at position 10 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;

Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;

Xaa at position 12 is His, Thr, Phe, Gly, Arg, Ala, or Trp;

20   Xaa at position 13 is Leu, Gly, Arg, Thr, Ser, or Ala;

Xaa at position 14 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;

Xaa at position 15 is Gln, Asn, Leu, Pro, Arg, or Val;

Xaa at position 16 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or

Lys;

25   Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;

Xaa at position 18 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;

Xaa at position 19 is Pro, Leu, Gln, Ala, Thr, or Glu;

Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Glu, Gln,

        Thr, Arg, Ala, Phe, Ile or Met;

30   Xaa at position 21 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

Xaa at position 22 is Asp, Leu, or Val;

Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;

Xaa at position 24 is Asn, or Ala;

Xaa at position 26 is Leu, Trp, or Arg;

35   Xaa at position 27 is Asn, Cys, Arg, Leu, His, Met, Pro;

Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Lys, Asn,

        Thr, Leu, Val, Glu, Phe, Tyr, Ile or Met;

Xaa at position 29 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,

     Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 30 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

     Trp, Glu, Asn, Gln, Ala or Pro;

5   Xaa at position 31 is Gln, Pro, Phe, Val, Met, Leu, Thr,

     Lys, Asp, Asn, Arg, Ser, Ala, Ile, Glu, His or Trp;

Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,

     Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

Xaa at position 33 is Ile, Gly, Val, Ser, Arg, Pro, or His;

10   Xaa at position 34 is Leu, Ser, Cys, Arg, Ile, His, Phe,

     Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 35 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 36 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

     Ser, Ala, Ile, Val, His, Phe, Met or Gln;

15   Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 38 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 39 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or

     Met;

Xaa at position 40 is Arg, Asp, Ile, Ser, Val, Thr, Gln,

20   Asn, Lys, His, Ala or Leu;

Xaa at position 41 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,

     His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

Xaa at position 43 is Asn or Gly;

25   Xaa at position 44 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

Xaa at position 45 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 46 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 47 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

Xaa at position 48 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

30   Xaa at position 49 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 50 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 51 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 53 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or

35   His;

Xaa at position 54 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or

Leu;

Xaa at position 56 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 57 is Ala, Met, Leu, Pro, Arg, Glu, Thr,

Gln, Trp, or Asn;

5   Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 60 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 61 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, Gln,

or

10   Leu;

Xaa at position 62 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or

Asp;

Xaa at position 63 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 64 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

15   Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or Asp;

Xaa at position 66 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 67 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 68 is Leu, Gln, Lys, Trp, Arg, Asp, Glu,

Asn, His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

20   Xaa at position 69 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 70 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 71 is Leu, Asn, Val, or Gln;

Xaa at position 72 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 73 is Leu, Ser, Trp, or Gly;

25   Xaa at position 74 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 75 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or

Ser;

Xaa at position 76 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

30   Xaa at position 78 is Pro, Phe, Arg, Ser, Lys, His, Ala,

Gly, Ile or Leu;

Xaa at position 79 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 80 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

Lys, His, Ala or Pro;

35   Xaa at position 81 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile or Tyr;

Xaa at position 82 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 83 is Ile, Val, Lys, Ala, or Asn;

Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr,

       Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 85 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

5   Gly, Ser, Phe, or His;

Xaa at position 86 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, Pro;

Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,

       Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu or Gln;

Xaa at position 88 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

10 Xaa at position 89 is Asp, or Ser;

Xaa at position 90 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

       Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

       Tyr, Leu, Lys, Ile, Asp, or His;

15 Xaa at position 92 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

Xaa at position 94 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

       His, Ser, Ala, or Pro;

Xaa at position 95 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 96 is Lys, Asn, Thr, Leu, Gln, Arg,

20   His, Glu, Ser, Ala or Trp;

Xaa at position 97 is Leu, Ile, Arg, Asp, or Met;

Xaa at position 98 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 99 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

       Asp, Lys, Leu, Ile, Val or Asn;

25 Xaa at position 100 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

Xaa at position 101 is Leu, Asn, Val, Pro, Arg, Ala, His,

       Thr, Trp, or Met;

Xaa at position 102 is Lys, Leu, Pro, Thr, Met, Asp, Val,

       Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or

30   Ile;

Xaa at position 103 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

Xaa at position 104 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 105 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 106 is Asn, Ala, Pro, Leu, His, Val, or Gln;

35 Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro,

       His, Ile, Tyr, or Cys;

Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding native amino acids of (1-133) human interleukin-3;

R$_2$ is a hematopoietic growth factor;

L is a linker capable of Linking R$_1$ to R$_2$; and said chimera protein can additionally be preceded by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2}, alanine^{-1}); and

(c) harvesting said cultured stem cells; and
(d) transplanting said cultured stem cells into said patient.

22. A method for treatment of a patient having a hematopoietic disorder, comprising the steps of;

(a) removing stem cells from said patient or a donor;
(b) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

R$_1$-L-R$_2$, R$_2$-L-R$_1$, R$_1$-R$_2$, R$_2$-R$_1$, R$_1$-L-R$_1$ and R$_1$-R$_1$

wherein R$_1$ is a human interleukin-3 mutant polypeptide of SEQ ID NO:7

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile; Xaa at position 19 is Met, Ala or Ile; Xaa at position 20 is Ile, Pro or Leu; Xaa at position 23 is Ile, Ala or Leu; Xaa at position 25 is Thr or His; Xaa at position 29 is Gln, Arg, Val or Leu; Xaa at position 32

is Leu, Ala, Asn or Arg; Xaa at position 34 is Leu or
Ser; Xaa at position 37 is Phe, Pro, or Ser; Xaa at
position 38 is Asn or Ala; Xaa at position 42 is Gly,
Ala, Ser, Asp or Asn; Xaa at position 45 is Gln, Val,

5   or Met; Xaa at position 46 is Asp or Ser; Xaa at
position 49 is Met, Ile, Leu or Asp; Xaa at position 50
is Glu or Asp; Xaa at position 51 is Asn Arg or Ser;
Xaa at position 55 is Arg, Leu, or Thr; Xaa at position
56 is Pro or Ser; Xaa at position 59 is Glu or Leu; Xaa

10 at position 60 is Ala or Ser; Xaa at position 62 is
Asn, Val or Pro; Xaa at position 63 is Arg or His; Xaa
at position 65 is Val or Ser; Xaa at position 67 is
Ser, Asn, His or Gly; Xaa at position 69 is Gln or
Glu; Xaa at position 73 is Ala or Gly; Xaa at position

15 76 is Ser, Ala or Pro; Xaa at position 79 is Lys, Arg
or Ser; Xaa at position 82 is Leu, Glu, Val or Trp; Xaa
at position 85 is Leu or Val; Xaa at position 87 is
Leu, Ser, Trp; Xaa at position 88 is Ala or Trp; Xaa at
position 91 is Ala or Pro; Xaa at position 93 is Pro or

20 Ser; Xaa at position 95 is His or Thr; Xaa at position
98 is His, Ile, or Thr; Xaa at position 100 is Lys or
Arg; Xaa at position 101 is Asp, Ala or Met; Xaa at
position 105 is Asn or Gln; Xaa at position 109 is Arg,
Glu or Leu; Xaa at position 112 is Thr or Gln; Xaa at

25 position 116 is Lys, Val, Trp or Ser; Xaa at position
117 is Thr or Ser; Xaa at position 120 is Asn, Gln, or
His; Xaa at position 123 is Ala or Glu; with the
proviso that from four to forty-four of the amino acids
designated by Xaa are different from the corresponding

30 amino acids of native human interleukin-3);

R$_2$ is a hematopoietic growth factor;

L is a linker capable of Linking R$_1$ to R$_2$;

35 and said chimera protein can additionally be preceded
by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2},
alanine^{-1}); and

(c) harvesting said cultured stem cells; and

(d) transplanting said cultured stem cells into said patient.

23. A method for treatment of a patient having a hematopoietic disorder, comprising the steps of;

(a) removing stem cells from said patient or a donor;

(b) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:8

wherein m is 0 or 1; n is 0 or 1; p is 0 or 1; Xaa at position 4 is Asn or Ile; Xaa at position 5 is Met, Ala or Ile: Xaa at position 6 is Ile, Pro or Leu; Xaa at position 9 is Ile, Ala or Leu; Xaa at position 11 is Thr or His; Xaa at position 15 is Gln, Arg, Val or Leu; Xaa at position 18 is Leu, Ala, Asn or Arg; Xaa at position 20 is Leu or Ser; Xaa at position 23 is Phe, Pro, or Ser; Xaa at position 24 is Asn or Ala; Xaa at position 28 is Gly, Ala, Ser, Asp or Asn; Xaa at position 31 is Gln, Val, or Met; Xaa at position 32 is Asp or Ser; Xaa at position 35 is Met, Ile, Leu or Asp; Xaa at position 36 is Glu or Asp; Xaa at position 37 is Asn, Arg or Ser; Xaa at position 41 is Arg, Leu, or Thr; Xaa at position 42 is Pro or Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Asn, Val or Pro; Xaa at position 49 is Arg or His; Xaa at position 51 is Val or Ser; Xaa at

position 53 is Ser, Asn, His or Gly; Xaa at position 55 is Gln or Glu; Xaa at position 59 is Ala or Gly; Xaa at position 62 is Ser, Ala or Pro; Xaa at position 65 is Lys, Arg or Ser; Xaa at position 67 is Leu, Glu, or

5 Val; Xaa at position 68 is Leu, Glu, Val or Trp; Xaa at position 71 is Leu or Val; Xaa at position 73 is Leu, Ser or Trp; Xaa at position 74 is Ala or Trp; Xaa at position 77 is Ala or Pro; Xaa at position 79 is Pro or Ser; Xaa at position 81 is His or Thr; Xaa at

10 position 84 is His, Ile, or Thr; Xaa at position 86 is Lys or Arg; Xaa at position 87 is Asp, Ala or Met; Xaa at position 91 is Asn or Glu; Xaa at position 95 is Arg, Glu, Leu; Xaa at position 98 Thr or Gln; Xaa at position 102 is Lys, Val, Trp or Ser; Xaa at position

15 103 is Thr or Ser; Xaa at position 106 is Asn, Gln, or His; Xaa at position 109 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native (15-125)human interleukin-3;

20

R$_2$ is a hematopoietic growth factor;

L is a linker capable of Linking R$_1$ to R$_2$;
and said chimera protein can additionally be preceded

25 by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2},
alanine^{-1}); and

(c) harvesting said cultured stem cells; and
(d) transplanting said cultured stem cells

30 into said patient.

24. The method according to claim 1 wherein R$_1$ is selected from the group consisting of:

35 Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro

Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:9;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:10;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:11;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:12;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
5   Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:13;
10

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
15   Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:14;
20

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
25   Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:15;
30

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
35   Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr

Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:16;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
5   Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
10   Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:17;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
15   Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
20   Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ
ID NO:18;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
25   Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
30   Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:19;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
35   Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn

```
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:20;


Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ
ID NO:21;


Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:22;


Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:23;


Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
```

```
        Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
        Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
        Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
        Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
    5   Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
        Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
        Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
        ID NO:24;


   10   Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
        Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
        Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
        Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
        Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
   15   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
        Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
        Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
        Gln SEQ ID NO:25;


   20   Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
        Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
        Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
        Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
        Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
   25   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
        Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
        Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
        Gln SEQ ID NO:26;


   30   Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
        Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
        Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
        Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
        Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
   35   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
        Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
        Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
```

Gln SEQ ID NO:27;

```
    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
 5  Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
    Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
    Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
    Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
10  Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
```

Gln SEQ ID NO:28;

```
    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
15  Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
    Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
    Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
    Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
    Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
20  Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
```

Gln SEQ ID NO:29;

```
    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
25  Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
    Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu
    Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro
    Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys
30  Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln
```

Gln SEQ ID NO:30;

```
    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
    Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
35  Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
    Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
    Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
```

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:31;

5

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu

10 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:32;

15

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu

20 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:33;

25

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

30 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:34;

35

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
5   Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:35;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
10   Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
15   Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:36;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
20   Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
25   Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:37;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
30   Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
35   Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:38;

```
Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:39;
```

```
Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg
Leu Ser Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:40;
```

```
Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ala Ile His His
Leu Lys Arg Pro Pro Ala Pro Ser Leu Asp Pro Asn Asn Leu
Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:41;
```

```
Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
```

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Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:42;
```

```
5    Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
     Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
     Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg
     Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
     Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
10   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
     Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
     Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
     Gln SEQ ID NO:43;
```

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15   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
     Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
     Asn Asp Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg
     Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
     Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
20   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
     Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
     Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
     Gln SEQ ID NO:44;
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25   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
     Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu
     Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg
     Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
     Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
30   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
     Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
     Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
     Gln SEQ ID NO:45;
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35   Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
     Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
     Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
```

Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
5   Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:46;

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
10   Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
15   Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:47; and

20   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Leu Ile His His
Leu Lys Ile Pro Pro Asn Pro Ser Leu Asp Ser Ala Asn Leu
Asn Ser Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
25   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:48.

30   25.   The method of claim 20, 21, 22, 23 or 24
wherein is R2 is R1 or a hematopoietic growth factor
selected from the group consisting of: GM-CSF, CSF-1,
G-CSF, G-CSF Ser[17], c-mpl ligand (MGDF or TPO), M-CSF,
erythropoietin (EPO), IL-1, IL-2, IL-3, IL-4, IL-5, IL-
35   6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15,
IL-16, LIF, flt3 ligand, human growth hormone, B-cell
growth factor, B-cell differentiation factor,

eosinophil differentiation factor and stem cell factor (SCF);

26.   The method of claim 25 wherein is R_2 is
selected from the group consisting of G-CSF, G-CSF
Ser^{17}, flt3 ligand and c-mpl ligand.

27.   The method of claim 21 wherein said
chimera protein is selected from group consisting of:
SEQ ID NO:121, 122, 123, 124, 125, 126, 127, 128, 129,
130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140,
141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151,
152, 153, 154, 155, 156, 157, 158, 159, 165, 166, 167
and 168.

28.   The method of claim 28 wherein said
chimera protein is selected from group consisting of:
SEQ ID NO:124, SEQ ID NO:133, SEQ ID NO:154 and SEQ ID
NO:155.

29. The method of claim 20, 21, 22, 23, 24,
27 or 28 wherein said culture medium further comprises
a hematopoietic growth factor selected from the group
consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl
ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-
1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-
11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human
growth hormone, B-cell growth factor, B-cell
differentiation factor, eosinophil differentiation
factor and stem cell factor (SCF).

30. The method of claim 25 wherein said
culture medium further comprises a hematopoietic growth
factor selected from the group consisting of: GM-CSF,
CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO),
M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5,
IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-

15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF).

5

      31. The method of claim 26 wherein said culture medium further comprises a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO),
10 M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor
15 (SCF).

      32. The method of claim 20 wherein said mutant human interleukin-3 polypeptide has at least three times greater activity than native human
20 interleukin-3, in at least one assay selected from the group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.

      33. The method of claim 25 wherein said
25 mutant human interleukin-3 polypeptide has at least three times greater activity than native human interleukin-3, in at least one assay selected from the group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.
30

      34. The method of claim 20 further comprising the step of separating the stem cells from a mixed population of cells prior to culturing the stem cells.

35   35. The method of claim 34 wherein said stem cells are separated from a mixed population of cells based on the stem cells having CD34 surface antigen.

36. A method of human gene therapy, comprising the steps of;

5   (a) removing stem cells from a patient or donor

           (b) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

10   R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

           wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:1

15

wherein
Xaa at position 17 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;
Xaa at position 19 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;
20   Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;
Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,
           Gln, Asn, Thr, Ser or Val;
Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, Asp,
           Asn, Gln, Leu, Val or Gly;
25   Xaa at position 23 is Ile, Val, Ala, Leu, Gly, Trp, Lys,
           Phe, Ser, or Arg;
Xaa at position 24 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;
Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;
Xaa at position 26 is His, Thr, Phe, Gly, Arg, Ala, or Trp;
30   Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;
Xaa at position 28 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;
Xaa at position 29 is Gln, Asn, Leu, Pro, Arg, or Val;
Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or
           Lys;
35   Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;
Xaa at position 32 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;
Xaa at position 33 is Pro, Leu, Gln, Ala, Thr, or Glu;

Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Glu, Gln,

Thr, Arg, Ala, Phe, Ile or Met;

Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

Xaa at position 36 is Asp, Leu, or Val;

5 Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;

Xaa at position 38 is Asn, or Ala;

Xaa at position 40 is Leu, Trp, or Arg;

Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, or Pro;

Xaa at position 42 is Gly, Asp, Ser, Cys, Asn, Lys, Thr,

10 Leu, Val, Glu, Phe, Tyr, Ile, Met or Ala;

Xaa at position 43 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,

Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

Trp, Glu, Asn, Gln, Ala or Pro;

15 Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr,

Lys, Trp, Asp, Asn, Arg, Ser, Ala, Ile, Glu or His;

Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,

Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

Xaa at position 47 is Ile, Gly, Val, Ser, Arg, Pro, or His;

20 Xaa at position 48 is Leu, Ser, Cys, Arg, Ile, His, Phe,

Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 50 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

Ser, Ala, Ile, Val, His, Phe, Met or Gln;

25 Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys,

Ser, or Met;

Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln,

30 Asn, Lys, His, Ala or Leu;

Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,

His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

Xaa at position 57 is Asn or Gly;

35 Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

Xaa at position 59 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 60 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

Xaa at position 62 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 63 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 64 is Ala, Asn, Pro, Ser, or Lys;

5   Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or
        His;

Xaa at position 68 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

10   Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or
Leu;

Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 71 is Ala, Met, Leu, Pro, Arg, Glu, Thr,
        Gln, Trp, or Asn;

15   Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 74 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg,
        Ser, Gln, or Leu;

20   Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or
        Asp;

Xaa at position 77 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 78 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

Xaa at position 79 is Lys, Thr, Asn, Met, Arg, Ile, Gly, or Asp;

25   Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn, His,
        Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

Xaa at position 83 is Pro, Ala, Thr, Trp, Arg, or Met;

30   Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 85 is Leu, Asn, Val, or Gln;

Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 87 is Leu, Ser, Trp, or Gly;

Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;

35   Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or
        Ser;

Xaa at position 90 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, Ala,

Gly, Ile or Leu;

Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

5   Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

Lys, His, Ala, or Pro;

Xaa at position 95 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile, or Tyr;

Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;

10   Xaa at position 97 is Ile, Val, Lys, Ala, or Asn;

Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 99 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

Gly, Ser, Phe, or His;

15   Xaa at position 100 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, or

Pro;

Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,

Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu, or Gln;

Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

20   Xaa at position 103 is Asp, or Ser;

Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

Tyr, Leu, Lys, Ile, Asp, or His;

25   Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

Xaa at position 108 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

His, Ser, Ala or Pro;

Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 110 is Lys, Ala, Asn, Thr, Leu, Arg, Gln,

30   His, Glu, Ser, or Trp;

Xaa at position 111 is Leu, Ile, Arg, Asp, or Met;

Xaa at position 112 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 113 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

Asp, Lys, Leu, Ile, Val or Asn;

35   Xaa at position 114 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

Xaa at position 115 is Leu, Asn, Val, Pro, Arg, Ala, His,

Thr, Trp, or Met;

Xaa at position 116 is Lys, Leu, Pro, Thr, Met, Asp, Val,

Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or

Ile;

Xaa at position 117 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

Xaa at position 118 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 119 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 120 is Asn, Ala, Pro, Leu, His, Val, or Gln;

Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro,

His, Ile, Tyr, or Cys;

Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 1 to 14 amino acids can be deleted from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus of said human interleukin-3 mutant polypeptide; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133) human interleukin-3;

R_2 is a hematopoietic growth factor; and

L is a linker capable of Linking R_1 to R_2; and said chimera protein can additionally be preceded by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2}, alanine^{-1}); and

(c) transducing DNA into said cultured cells;

(d) harvesting said transduced cells; and

(e) transplanting said transduced cells into said patient.

37. A method of human gene therapy, comprising the steps of;

(a) removing stem cells from a patient or a

donor;

(b) culturing said stem cells with a selected growth medium comprising a chimera protein having the formula selected from the group consisting of:

5

       R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

       wherein R_1 is a human interleukin-3 mutant

10 polypeptide of SEQ ID NO:4

wherein

Xaa at position 3 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;

Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;

15 Xaa at position 5 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;

Xaa at position 6 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;

Xaa at position 7 is Asp, Phe, Lys, Arg, Ala, Gly, Glu,

       Gln, Asn, Thr, Ser or Val;

Xaa at position 8 is Glu, Trp, Pro, Ser, Ala, His, Asp,

20   Asn, Gln, Leu, Val, or Gly;

Xaa at position 9 is Ile, Val, Ala, Leu, Gly, Trp, Lys,

       Phe, Ser, or Arg;

Xaa at position 10 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;

Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;

25 Xaa at position 12 is His, Thr, Phe, Gly, Arg, Ala, or Trp;

Xaa at position 13 is Leu, Gly, Arg, Thr, Ser, or Ala;

Xaa at position 14 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;

Xaa at position 15 is Gln, Asn, Leu, Pro, Arg, or Val;

Xaa at position 16 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or

30   Lys;

Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;

Xaa at position 18 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;

Xaa at position 19 is Pro, Leu, Gln, Ala, Thr, or Glu;

Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Glu, Gln,

35   Thr, Arg, Ala, Phe, Ile or Met;

Xaa at position 21 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;

Xaa at position 22 is Asp, Leu, or Val;

Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;

Xaa at position 24 is Asn, or Ala;

Xaa at position 26 is Leu, Trp, or Arg;

Xaa at position 27 is Asn, Cys, Arg, Leu, His, Met, Pro;

5   Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Lys, Asn,
            Thr, Leu, Val, Glu, Phe, Tyr, Ile or Met;

Xaa at position 29 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala,
            Cys, Gln, Arg, Thr, Gly or Ser;

Xaa at position 30 is Asp, Ser, Leu, Arg, Lys, Thr, Met,

10   Trp, Glu, Asn, Gln, Ala or Pro;

Xaa at position 31 is Gln, Pro, Phe, Val, Met, Leu, Thr,
            Lys, Asp, Asn, Arg, Ser, Ala, Ile, Glu, His or Trp;

Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Glu, Asn,
            Gln, Lys, His, Ala, Tyr, Ile, Val or Gly;

15   Xaa at position 33 is Ile, Gly, Val, Ser, Arg, Pro, or His;

Xaa at position 34 is Leu, Ser, Cys, Arg, Ile, His, Phe,
            Glu, Lys, Thr, Ala, Met, Val or Asn;

Xaa at position 35 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;

Xaa at position 36 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn,

20   Ser, Ala, Ile, Val, His, Phe, Met or Gln;

Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 38 is Asn, His, Arg, Leu, Gly, Ser, or Thr;

Xaa at position 39 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or
            Met;

25   Xaa at position 40 is Arg, Asp, Ile, Ser, Val, Thr, Gln,
            Asn, Lys, His, Ala or Leu;

Xaa at position 41 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Glu, Arg,
            His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;

30   Xaa at position 43 is Asn or Gly;

Xaa at position 44 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

Xaa at position 45 is Glu, Tyr, His, Leu, Pro, or Arg;

Xaa at position 46 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 47 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

35   Xaa at position 48 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 49 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 50 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 51 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 53 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or
        His;

5   Xaa at position 54 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or
        Leu;

Xaa at position 56 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 57 is Ala, Met, Leu, Pro, Arg, Glu, Thr,

10   Gln, Trp, or Asn;

Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

Xaa at position 60 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 61 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, Gln,

15   or Leu;

Xaa at position 62 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or
        Asp;

Xaa at position 63 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 64 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

20   Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or Asp;

Xaa at position 66 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 67 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 68 is Leu, Gln, Lys, Trp, Arg, Asp, Glu,

            Asn, His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

25   Xaa at position 69 is Pro, Ala, Thr, Trp, Arg, or Met;

Xaa at position 70 is Cys, Glu, Gly, Arg, Met, or Val;

Xaa at position 71 is Leu, Asn, Val, or Gln;

Xaa at position 72 is Pro, Cys, Arg, Ala, or Lys;

Xaa at position 73 is Leu, Ser, Trp, or Gly;

30   Xaa at position 74 is Ala, Lys, Arg, Val, or Trp;

Xaa at position 75 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or
        Ser;

Xaa at position 76 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;

Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;

35   Xaa at position 78 is Pro, Phe, Arg, Ser, Lys, His, Ala,
        Gly, Ile or Leu;

Xaa at position 79 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;

Xaa at position 80 is Arg, Ile, Ser, Glu, Leu, Val, Gln,

Lys, His, Ala or Pro;

Xaa at position 81 is His, Gln, Pro, Arg, Val, Leu, Gly,

Thr, Asn, Lys, Ser, Ala, Trp, Phe, Ile or Tyr;

5   Xaa at position 82 is Pro, Lys, Tyr, Gly, Ile, or Thr;

Xaa at position 83 is Ile, Val, Lys, Ala, or Asn;

Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;

Xaa at position 85 is Ile, Leu, Arg, Asp, Val, Pro, Gln,

10   Gly, Ser, Phe, or His;

Xaa at position 86 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln, Pro;

Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,

Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu or Gln;

Xaa at position 88 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;

15   Xaa at position 89 is Asp, or Ser;

Xaa at position 90 is Trp, Val, Cys, Tyr, Thr, Met, Pro,

Leu, Gln, Lys, Ala, Phe, or Gly;

Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln,

Tyr, Leu, Lys, Ile, Asp, or His;

20   Xaa at position 92 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;

Xaa at position 94 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,

His, Ser, Ala, or Pro;

Xaa at position 95 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;

Xaa at position 96 is Lys, Asn, Thr, Leu, Gln, Arg,

25   His, Glu, Ser, Ala or Trp;

Xaa at position 97 is Leu, Ile, Arg, Asp, or Met;

Xaa at position 98 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;

Xaa at position 99 is Phe, Ser, Cys, His, Gly, Trp, Tyr,

Asp, Lys, Leu, Ile, Val or Asn;

30   Xaa at position 100 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;

Xaa at position 101 is Leu, Asn, Val, Pro, Arg, Ala, His,

Thr, Trp, or Met;

Xaa at position 102 is Lys, Leu, Pro, Thr, Met, Asp, Val,

Glu, Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or

35   Ile;

Xaa at position 103 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;

Xaa at position 104 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 105 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;

Xaa at position 106 is Asn, Ala, Pro, Leu, His, Val, or Gln;

Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro,

5   His, Ile, Tyr, or Cys;

Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding native amino

10   acids of (1-133) human interleukin-3;

R_2 is a hematopoietic growth factor; and

L is a linker capable of Linking R_1 to R_2;

15   and said chimera protein can additionally be preceded by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2}, alanine^{-1}); and

(c) transducing DNA into said cultured cells;

20   (d) harvesting said transduced cells; and

(e) transplanting said transduced cells into said patient.

25   38. A method of human gene therapy, comprising the steps of;

(a) removing stem cells from a patient or a donor   (b) culturing said stem cells with a selected

30   growth medium comprising a chimera protein having the formula selected from the group consisting of:

R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

35   wherein R_1 is a human interleukin-3 mutant polypeptide of SEQ ID NO:7

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile; Xaa at position 19 is Met, Ala or Ile; Xaa at position 20 is Ile, Pro or Leu; Xaa at position 23 is Ile, Ala or Leu; Xaa at position 25 is Thr or His; Xaa at

5 position 29 is Gln, Arg, Val or Leu; Xaa at position 32 is Leu, Ala, Asn or Arg; Xaa at position 34 is Leu or Ser; Xaa at position 37 is Phe, Pro, or Ser; Xaa at position 38 is Asn or Ala; Xaa at position 42 is Gly, Ala, Ser, Asp or Asn; Xaa at position 45 is Gln, Val,

10 or Met; Xaa at position 46 is Asp or Ser; Xaa at position 49 is Met, Ile, Leu or Asp; Xaa at position 50 is Glu or Asp; Xaa at position 51 is Asn Arg or Ser; Xaa at position 55 is Arg, Leu, or Thr; Xaa at position 56 is Pro or Ser; Xaa at position 59 is Glu or Leu; Xaa

15 at position 60 is Ala or Ser; Xaa at position 62 is Asn, Val or Pro; Xaa at position 63 is Arg or His; Xaa at position 65 is Val or Ser; Xaa at position 67 is Ser, Asn, His or Gly; Xaa at position 69 is Gln or Glu; Xaa at position 73 is Ala or Gly; Xaa at position

20 76 is Ser, Ala or Pro; Xaa at position 79 is Lys, Arg or Ser; Xaa at position 82 is Leu, Glu, Val or Trp; Xaa at position 85 is Leu or Val; Xaa at position 87 is Leu, Ser, Trp; Xaa at position 88 is Ala or Trp; Xaa at position 91 is Ala or Pro; Xaa at position 93 is Pro or

25 Ser; Xaa at position 95 is His or Thr; Xaa at position 98 is His, Ile, or Thr; Xaa at position 100 is Lys or Arg; Xaa at position 101 is Asp, Ala or Met; Xaa at position 105 is Asn or Gln; Xaa at position 109 is Arg, Glu or Leu; Xaa at position 112 is Thr or Gln; Xaa at

30 position 116 is Lys, Val, Trp or Ser; Xaa at position 117 is Thr or Ser; Xaa at position 120 is Asn, Gln, or His; Xaa at position 123 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding

35 amino acids of native human interleukin-3;

R$_2$ is a hematopoietic growth factor; and

L is a linker capable of Linking R_1 to R_2;
and said chimera protein can additionally be preceded
by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2},

5   alanine^{-1}); and

(c) transducing DNA into said cultured cells;

(d) harvesting said transduced cells; and

(e) transplanting said transduced cells into

10   said patient.

39. A method of human gene therapy,
comprising the steps of;

15   (a) removing stem cells from a patient or a
donor;

(b) culturing said stem cells with a selected
growth medium comprising a chimera protein having the
formula selected from the group consisting of:

20

  R_1-L-R_2, R_2-L-R_1, R_1-R_2, R_2-R_1, R_1-L-R_1 and R_1-R_1

wherein R_1 is a human interleukin-3 mutant
polypeptide of

25

wherein R_1 is a human interleukin-3 mutant polypeptide
of SEQ ID NO:8

wherein m is 0 or 1; n is 0 or 1; p is 0 or 1; Xaa at

30   position 4 is Asn or Ile; Xaa at position 5 is Met, Ala
or Ile: Xaa at position 6 is Ile, Pro or Leu; Xaa at
position 9 is Ile, Ala or Leu; Xaa at position 11 is
Thr or His; Xaa at position 15 is Gln, Arg, Val or Leu;
Xaa at position 18 is Leu, Ala, Asn or Arg; Xaa at

35   position 20 is Leu or Ser; Xaa at position 23 is Phe,
Pro, or Ser; Xaa at position 24 is Asn or Ala; Xaa at
position 28 is Gly, Ala, Ser, Asp or Asn; Xaa at

position 31 is Gln, Val, or Met; Xaa at position 32 is
Asp or Ser; Xaa at position 35 is Met, Ile, Leu or Asp;
Xaa at position 36 is Glu or Asp; Xaa at position 37 is
Asn, Arg or Ser; Xaa at position 41 is Arg, Leu, or

5   Thr; Xaa at position 42 is Pro or Ser; Xaa at position
45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa
at position 48 is Asn, Val or Pro; Xaa at position 49
is Arg or His; Xaa at position 51 is Val or Ser; Xaa at
position 53 is Ser, Asn, His or Gly; Xaa at position 55

10 is Gln or Glu; Xaa at position 59 is Ala or Gly; Xaa at
position 62 is Ser, Ala or Pro; Xaa at position 65 is
Lys, Arg or Ser; Xaa at position 67 is Leu, Glu, or
Val; Xaa at position 68 is Leu, Glu, Val or Trp; Xaa
at position 71 is Leu or Val; Xaa at position 73 is

15 Leu, Ser or Trp; Xaa at position 74 is Ala or Trp; Xaa
at position 77 is Ala or Pro; Xaa at position 79 is Pro
or Ser; Xaa at position 81 is His or Thr; Xaa at
position 84 is His, Ile, or Thr; Xaa at position 86 is
Lys or Arg; Xaa at position 87 is Asp, Ala or Met; Xaa

20 at position 91 is Asn or Glu; Xaa at position 95 is
Arg, Glu, Leu; Xaa at position 98 Thr or Gln; Xaa at
position 102 is Lys, Val, Trp or Ser; Xaa at position
103 is Thr or Ser; Xaa at position 106 is Asn, Gln, or
His; Xaa at position 109 is Ala or Glu; with the

25 proviso that from four to forty-four of the amino acids
designated by Xaa are different from the corresponding
amino acids of native (15-125)human interleukin-3;

R_2 is a hematopoietic growth factor; and

30

L is a linker capable of Linking R_1 to R_2;
and said chimera protein can additionally be preceded
by (methionine^{-1}), (alanine^{-1}), or (methionine^{-2},
alanine^{-1}); and

35

(c) transducing DNA into said cultured cells;
(d) harvesting said transduced cells; and

(e) transplanting said transduced cells into said patient.

40. The method according to claim 39 wherein R₁ is selected from the group consisting of:

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Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:9;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:10;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:11;

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
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Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
5   Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:12;

10 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
15 Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:13;

20 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
25 Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:14;

30 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
35 Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ

ID NO:15;

     Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
     Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
  5 Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
     Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
     Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
     Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
     Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Arg Lys Leu Thr
 10 Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
     ID NO:16;

     Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
     Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 15 Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
     Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
     Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
     Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
     Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
 20 Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
     ID NO:17;

     Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
     Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 25 Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
     Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
     Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
     Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
     Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Glu Lys Leu Thr
 30 Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ
     ID NO:18;

     Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
     Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
 35 Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
     Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
     Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys

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Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:19;
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Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:20;
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Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu Lys
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro
Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln Gln SEQ
ID NO:21;
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Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:22;
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Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
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Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:23;

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys
Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro Ile His
Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr
Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln Gln SEQ
ID NO:24;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:25;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His
Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu
Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg
Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu
Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:26;

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His

Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu

Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg

5   Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu

Gln Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln

10   Gln SEQ ID NO:27;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg

15   Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu

Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro

Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys

Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln

20   Gln SEQ ID NO:28;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

25   Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu

Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu

Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro

Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys

Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln

30   Gln SEQ ID NO:29;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

35   Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu

Pro Cys Leu Pro Leu Ala Thr Ala Ala Pro Thr Arg His Pro

Ile His Ile Lys Asp Gly Asp Trp Asn Glu Phe Arg Arg Lys

Leu Thr Phe Tyr Leu Lys Thr Leu Glu Asn Ala Gln Ala Gln

Gln SEQ ID NO:30;

5   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

10   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:31;

15   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

20   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:32;

25   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

30   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:33;

35   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
5   Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:34;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
10   Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
15   Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:35;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu
20   Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
25   Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:36;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His
Leu Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu
30   Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg
Leu Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
35   Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln
Gln SEQ ID NO:37;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ser Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg

Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu

5 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:38;

10

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

15 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Val

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Thr Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Ser Leu Glu His Ala Gln Glu Gln

Gln SEQ ID NO:39;.

20

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg

Leu Ser Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

25 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:40;

30

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ala Ile His His

Leu Lys Arg Pro Pro Ala Pro Ser Leu Asp Pro Asn Asn Leu

Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

35 Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:41;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

5 Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

10 Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:42;

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

15 Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Ala Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

20 Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:43;

25 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Asp Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu

Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln

30 Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro

Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys

Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:44;

35 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His

Leu Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu

Asn Asp Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg

Leu Pro Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
5   Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln
Gln SEQ ID NO:45;

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
10   Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro
Asn Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
15   Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:46;

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys
20   Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys
Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro
Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn
Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys
25   Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile
Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr
Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln Gln SEQ
ID NO:47; and

30   Met Ala Asn Cys Ser Ile Met Ile Asp Glu Leu Ile His His
Leu Lys Ile Pro Pro Asn Pro Ser Leu Asp Ser Ala Asn Leu
Asn Ser Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg
Thr Pro Asn Leu Leu Ala Phe Val Arg Ala Val Lys His Leu
Glu Asn Ala Ser Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln
35   Pro Cys Leu Pro Ser Ala Thr Ala Ala Pro Ser Arg His Pro
Ile Ile Ile Lys Ala Gly Asp Trp Gln Glu Phe Arg Glu Lys
Leu Thr Phe Tyr Leu Val Thr Leu Glu Gln Ala Gln Glu Gln

Gln SEQ ID NO:48.

41. The method of claim 36, 37, 38, 39, or 40 wherein is R_2 is R_1 or a hematopoietic growth factor

5 selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell

10 growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF);

42. The method of claim 41 wherein is R_2 is

15 selected from the group consisting of G-CSF, G-CSF Ser^{17}, flt3 ligand or c-mpl ligand.

43. The method of claim 37 wherein said chimera protein is selected from group consisting of:

20 SEQ ID NO:121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 165, 166, 167 and 168.

25

44. The method of claim 43 wherein said chimera protein is selected from group consisting of: SEQ ID NO:124, SEQ ID NO:133, SEQ ID NO:154 and SEQ ID NO:155.

30

45. The method of claim 37, 38, 39, 40, or 63 wherein said culture medium further comprises a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl

35 ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human

growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF).

5   46. The method of claim 41 wherein said culture medium further comprises a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO), M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5,
10   IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor (SCF).

15

       47. The method of claim 42 wherein said culture medium further comprises a hematopoietic growth factor selected from the group consisting of: GM-CSF, CSF-1, G-CSF, G-CSF Ser^{17}, c-mpl ligand (MGDF or TPO),
20   M-CSF, erythropoietin (EPO), IL-1, IL-4, IL-2, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-16, LIF, flt3 ligand, human growth hormone, B-cell growth factor, B-cell differentiation factor, eosinophil differentiation factor and stem cell factor
25   (SCF).

       48. The method of claim 36 wherein said mutant human interleukin-3 polypeptide has at least three times greater activity than native human
30   interleukin-3, in at least one assay selected from the group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.

       49. The method of claim 41 wherein said
35   mutant human interleukin-3 polypeptide has at least three times greater activity than native human interleukin-3, in at least one assay selected from the

group consisting of: AML cell proliferation, TF-1 cell proliferation and Methylcellulose assay.

50. The method of claim 36 further comprising
5 the step of separating the stem cells from a mixed population of cells prior to culturing the stem cells.

51. The method of claim 50 wherein said stem cells are separated from a mixed population of cells
10 based on the stem cells having CD34 surface antigen.

52. Transduced stem cells obtained by the method of claim 36.

15 53. Transduced stem cells obtained by the method of claim 41.

54. Transduced stem cells obtained by the method of claim 49.
20